# Engineers' Voice in the Internet Economy

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Abstract: Two key characteristics of the Internet economy - easy capital for start-ups and a focus on time to market - coupled with a tight labor market and bullish stock market, created a market-driven labor market that affected the voice and labor market outcomes for engineers. Rapidly changing technology and the rush to market resulted in young engineers' bargaining power increasing relative to experienced engineers. Voice and career building, which had been exercised within a company's internal labor market, now became exercised through job-hopping and professional networks. Internet engineers gave up security and stable earnings for high-risk, high-return compensation packages.

The Internet economy, which has changed the ways that businesses operate and people communicate, has changed the way the labor market functions by creating new norms for its own market for engineers and managers. In 1999 the media embraced the legends of 25 year-old CEOs, IPO multi-millionaires, Porsche signing bonuses, foosball tables, and money everywhere. In 2000 the new legends are of young engineers wearing their failed startups as badges of honor, stock-options that are under water, engineers running from startups to established firms and job security, and doom everywhere. These legends capture (and create) common perceptions of the Silicon Valley, but how well do they capture the experience and bargaining power of the Internet economy's average engineer? By analyzing the careers and labor market outcomes of Internet engineers, this paper provides a snapshot of how the labor market for engineers is evolving. First we discuss how several key characteristics of the Internet economy affect the voice and labor market outcomes of engineers. Then we use data from original fieldwork to ask what engineers want in their jobs. Finally, we discuss current trends in the Internet economy and their implications for the future of engineers' labor market.

**Engineers' Voice**

Freeman's 1980 seminal article applies Hirschman's exit-voice dichotomy to the unionized workplace to analyze how workers can use "voice" (especially through the grievance system) rather than "exit" when dissatisfied with conditions. Many nonunion companies, often in order to keep unions out, have instituted grievance and other procedures that allow employees voice (Jacoby, 1997). These procedures are part of a large company's internal labor market, which allows professional employees, who forego leaving for a higher wage in boom times, and employers, who forego laying off in downturns, to share risk over the business cycle and to share the costs and returns to training. (Brown, et al, 1997).

Engineers care deeply about their job assignment and want challenging projects that allows them to learn the latest technology. At work they want their voice to be heard through

their contribution, and so they have used movement through their company's internal labor market both for voice and for career building. However new high-tech companies, especially in the Silicon Valley, changed the rules governing career ladders, training, and security, with the rise of the Internet economy during the past decade (Cappelli, 1999). The Internet workforce became more market-driven, and engineers began to rely more on job hopping and professional networks and less on company ties to express their voice and build their career. Two things--strong labor market demand and bullish stock markets--facilitated these changes. In a hot labor market, the reward for risk sharing with a company becomes less attractive as the threat of unemployment fades. Bullish stock markets in the mid-1990s allowed early stage companies to offer high-reward, high-risk stock options, while older high-tech companies offered equity whose value tended to stagnant. Knowing only strong labor and stock markets, young engineers enthusiastically spurned the job security and reliable pay offered by internal labor markets in favor of job-hopping and equity-based pay offered by Internet companies. Many viewed the internal labor markets of older companies as holding them back and viewed the market-driven labor market of the Internet economy as offering them the latest technology challenges and possible wealth wealth.

**Creation of Internet Labor Spot Market**

The labor market for the Internet economy in the 1990s was based on venture capitalists making high-risk, high-reward investments in early stage companies. A guiding principle of the early Internet economy was "winner-take-all": the first company to provide a decent product to a new market would dominate. The perceived first-mover advantage led to two characteristics of the Internet economy that have important labor market implications:

- **"Internet Time"** - the focus on time-to-market drove companies to grow quickly and employees to work longer hours. Since throwing more computer scientists at a particular

problem does not necessarily accelerate a solution (the “pregnancy conundrum” of nine women creating a baby in one month), engineers worked long hours to meet aggressive deadlines.

- **Easy capital for start-ups** - investors sought to accelerate the rate of growth for young companies by offering large amounts of cheap capital. Companies with large bankrolls offer premium compensation packages to attract engineers with the latest skills.

The conditions of easy money and very short deadlines gave engineers in the Internet economy tremendous bargaining power. A hot labor market gave engineers bargaining power in the hiring process, and once hired and involved in projects, their power skyrocketed. This has translated to excellent labor market outcomes for engineers who have the latest skills and are willing to work long hours. Of course these are mostly recent graduates.

A very tight labor market allows engineers to choose among a diverse group of firms to pick the job that reflects their preferences. For example, risk-averse engineers can choose to work for established firms and risk-loving engineers can work at start-ups. Challenging projects creating and using the latest technology are highly demanded by skilled engineers, and are the primary way along with compensation for attracting and retaining talented engineers. Employers had to become creative with the compensation packages and had to give power to their new hires. One of the companies in our study allowed employees to choose how their compensation would be divided between cash and equity.

Although engineers with the latest skills have tremendous market power, engineers whose skills are not up-to-date do not fare as well. With large coffers of cash and a mandate to grow quickly, companies chose to pay high salaries for recent graduates rather than retrain experienced engineers. Consequently "vintage” engineers (over age 30 or so) get stuck working with the legacy technology. Engineers in high-tech industries have experienced declining returns to experience relative to professionals in other occupations throughout the 1990s (Brown and Campbell, forthcoming).

With rapidly changing technology, engineering knowledge quickly depreciates and engineers must continually update their skill base. While young engineers with the latest skills are working 100-hour workweeks in order to meet deadlines, they do not have the time to update their skills. This leads to a churning labor market where young engineers who developed the most recent skills in college are highly sought after for the first five to ten years of their careers. In the Internet economy as engineers age, they find their skills depreciate and they want to work less so they can spend time with their families. Engineers have a small window during which they have strong bargaining power, so many young engineers trade work conditions and security for higher and riskier compensation, since later in their careers they will be in less demand.

Over the course of the 1990s, easy capital and speed to market created a bifurcated labor market for engineers where young engineers wielded tremendous power, while experienced engineers were squeezed out of the best jobs by both domestic and temporary foreign workers. Young engineers were not only highly paid, but could choose many of the conditions of their work environment as long as they were willing to work long hours, while vintage engineers experienced declining bargaining power marked by a decrease in return to experience relative to professionals in other industries.

**Compensation**

We analyze compensation of Internet technical professionals using data collected from the Industry Standard's "Internet Workforce Compensation Study 2000." The Industry Standard finds the median annual salary ranged from $90,000 for software engineers to $60,000 for web production (see Table 1). Stock options are held by 39%-64% of employees in each occupation, while the median number of stock options varies between 2,500 and 8,000.

A similar survey conducted by Dice.com focuses on the difference in compensation between full-time engineers and contract engineers in the Information Technology (IT) industry,

which is a superset of the Internet industry. Dice.com finds that average annual earnings for IT professionals in the U.S. are $67,642, while a contractor earns $116,154, or a 71% premium. In the San Francisco Bay Area, IT professionals average $82,358 and contractors average $133,154, or a 61% premium. The difference in wages between full-time professionals and contractors reflects, in large part, the value that full-time workers place on stock options.

We can conduct back-of-the envelope calculations to estimate the value that Internet professionals place on stock options and their expectations of success. We present four scenarios to reflect a wide variation in annual earnings, contractor earnings premiums, and equity compensation across different occupations and companies (see Table 2). Case 1 covers software engineers working for a late-stage start-up or established company with a compensation package of $90,000 per year plus 5000 stock options, while the contractor earns 70% more and receives no stock options. Full-time engineers value their stock options at $12.60 per share (cet. par.). A typical rule-of-thumb in the Internet economy is that in a successful company after the three year vesting period, stock options will be worth $20 per share more than the strike price. Alternatively, an unsuccessful company will be worth nothing. Thus this typical engineer expects the probability of success to be approximately 63%. Three other scenarios (case 2 is engineer in early-stage companies; case 3 is technology professional at late stage company; case 4 is technology professional at early stage company) give implied probability of success of 23%, 70%, and 24% respectively. Even the smaller probabilities indicate that the Internet employees have very high expectations of success that exceed what would be considered rational. The irrational exuberance of the pre-March stock market seems to have affected their judgment.

**What Engineers Want**

Next we address the questions of what engineers want from their jobs and what their jobs want from them by analyzing a summer 1999 survey of engineers who at BayTech, an

engineering division of a large Bay Area telecommunications firm. Data for 153 on-site BayTech employees (engineers, analysts, and support staff) were collected through an employee questionnaire. BayTech employees have chosen to work at an established company and reflect the outcomes of relatively risk-averse high-tech workers. The average BayTech employee has 10.2 years of experience in the telecommunications field, and 3.6 years at BayTech. However, the sample includes both old-time employees and recently hired employees, and so the *median* experience levels are 5 years in telecommunications and 1.5 years at BayTech. This pattern is consistent with an established firm that is undergoing an intense growth phase.

Many BayTech employees work long hours; 58% report working more than 40 hours per week on average. Only 7% report working less than 40 hours per week. Typical of U.S. workers, our respondents rate their own work performance very high: 43% claim their performance is in the top 10% of the firm, 75% think their performance is in the top 25% of the firm. Our respondents are more realistic about their pay (compared to workers with similar talents): 16% think their compensation is in the top decile of pay, 56% claim to be in the top half, and 9% claim to be in the bottom decile. Taken together, the answers to these questions indicate the majority (54%) of respondents feels under-compensated, since they think their relative performance is higher than their relative compensation. One third (34%) feel adequately compensated since they think their relative performance and compensation fall in the same range. Only a small minority (11%) feels over-compensated with relative performance being higher than relative compensation.

Our sample of engineers think the evaluation system at BayTech is performance based: 81% think technical skills are important, 74% think creativity and initiative are important, and 95% think meeting goals or targets is important in their evaluation. Only 24% responded that seniority is important in their evaluation.

When we asked workers what is important to them in their jobs, they responded that they want to use their skills and creativity (94%) and compensation (90%). Over half also think

that job security (55%) and opportunity for advancement (52%) are very important. Most of our sample engineers also think that challenging projects (88%), opportunity for advancement (87%), and recognition of contribution (84%) are important and very important. They (78%) also value the ability to schedule time away from work. These responses of what workers want are similar to those reported by Freeman and Rogers (1999), who found that workers want voice and influence at work. However their sample of workers was prevented from having as much voice at work as desired because of management resistance. In contrast, our highly skilled engineers have much more power at work than the typical worker, and so what they want and what they get are closely matched, especially for the younger engineers.

BayTech exemplifies the labor market outcomes for many Silicon Valley engineers working at the more established, larger companies. These engineers want to be challenged and well compensated. BayTech rewards workers based upon ability to meet deadlines and skills, but does not reward experience. Yet BayTech engineers care about what happens to the experienced engineers, since the majority think employment security and opportunity of advancement are very important.

**What the Future Holds**

After the stock market turned downward in March 2000, young companies could no longer afford to be free spending. With cheap capital no longer available, companies had to control costs and focus on profits as well as focus on time to market. Layoffs, unheard of in high-tech industries during the 1990s, became an increasingly common occurrence (see figure 1), and a fall in the NASDAQ from over 5000 to under 3000 dramatically reduced the attraction of stock-options and equity compensation.

Firms must hire skilled engineers in order to grow, but employers lack the ability in 2001 to offer the same level of perks and signing bonuses as in early 2000. As the demand for engineers cools down and as the ability to pay (both in compensation and equity) declines at

most startups, the bargaining power of new hires declines at the established companies. Meanwhile engineers, who have been seen their dreams of valuable stock options tumble with the NASDAQ, have become more discriminating in evaluating prospective employment at startups. Experienced engineers face the same constraints as before the downturn. The emphasis on speed coupled with rapidly changing technology still reduces the value of experience.

In the market downturn, engineers are reevaluating the security and compensation packages offered by established firms, and they are adopting a more realistic evaluation of the stock options offered by both early stage and mature companies. We expect to see the compensation at start-ups to be comparable to the established companies, and to see risk-adverse engineers opt for internal labor market security and risk-lovers opt for start-up stock options. These two segments of the high-tech sector will also continue to express their voice and build their careers in different ways—internally within the established company or externally through job-hopping—but returns to experience will still lag behind that of other industries.

In the internal labor market of established companies, the risk sharing between companies and employees over the business cycle will continue. However the Internet economy has changed the internal labor market in very important ways that we think are long lasting:

- Assignments and performance: the most talented engineers will be put on the most challenging projects that create or use the latest technology, and performance rather than tenure will be used for project assignment and promotions.
- Training: engineers who want to keep up with the new technology will have to rely upon themselves to get the training rather than upon their companies, which are willing to pay for tuition but not to provide the training through the company.

Of course, when the United States experiences another nine-year expansion that produces tight labor markets and booming stock markets, we should expect younger workers' preferences to shift once more toward the spot market.

**Tables and Figures**

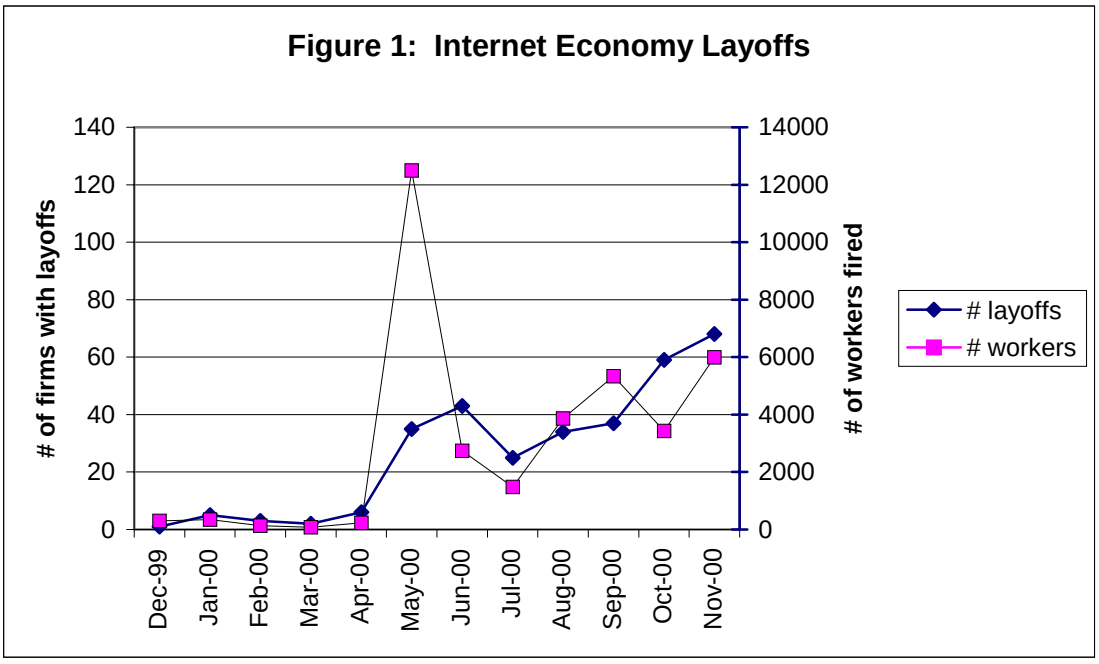
**Table 1. Median Compensation, Options, and Hours for Internet Professionals**

| | Information Systems Engineer | Software Engineer | Web Production | Web Design |
|---|---|---|---|---|
| Total Compensation | $77,000 | $90,000 | $60,000 | $61,000 |
| Base Compensation | $75,000 | $88,000 | $59,000 | $55,000 |
| Stock options | 39% | 64% | 48% | 56% |
| Median # of stock options | 4,000 | 8,000 | 3,000 | 2,500 |
| Average hours/day | 9.8 | 10.1 | 9.4 | 9.5 |

Source: The Industry Standard's "Internet Workforce Compensation Study 2000." http://www.thestandard.com/article/display/0,1151,18387,00.html

**Table 2: Internet Professional Compensation Packages and Implied Expectations**

| | Case 1 | Case 2 | Case 3 | Case 4 |
|---|---|---|---|---|
| Full-Time Engineers | $90,000 | $90,000 | $60,000 | $60,000 |
| Contractor Premium | 70% | 40% | 70% | 40% |
| # Stock Options | 5000 | 8000 | 3000 | 5000 |
| Implied Value of Stock Options | $12.60 | $4.50 | $14.00 | $4.80 |
| **Implied Probability of Success** | **63%** | **23%** | **70%** | **24%** |




Source: The Industry Standard's Layoff Tracker, http://search.thestandard.com/texis/trackers/layoff

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